

KSTRONG®
UNRIVALED SAFETY.

KS GROUP

MINING FALL PROTECTION & RESCUE WHITEPAPER



Protecting Workers at Height, in Confined Spaces, and During Rescue Operations

Disclaimer

This whitepaper is intended for general guidance and information purposes only. Mining organisations should conduct site-specific risk assessments and ensure compliance with applicable legislation, standards, and site procedures before selecting or using fall protection, rescue, confined space, or PPE equipment.

Table of Contents

Section	Page
Introduction	2
1.0 Mining Operations & Fall Hazards	2
2.0 Understanding Fall Protection	5
3.0 Fall Protection Systems for Mining	6
4.0 Rescue Readiness – The Missing Link	7
5.0 Confined Space Entry & Rescue	8
6.0 Digital Compliance & Smart Safety	9
7.0 Mining Applications Across Australia & Southeast Asia	9
8.0 Case Study – Conveyor Maintenance Improvement Program	10
9.0 Conclusion	11



Mining operations across the Asia Pacific continue to face significant safety challenges associated with working at height, confined space entry, maintenance activities, and emergency rescue. While automation and engineering controls have improved safety performance, workers remain exposed to hazards associated with conveyors, crushers, processing plants, tanks, silos, shafts, and elevated structures.

Falls from height remain among the highest consequence hazards in mining due to the potential for serious injury or fatality. Effective protection requires more than compliance with PPE requirements. Organizations must adopt a systems-based approach that combines fall protection equipment, engineered access systems, rescue preparedness, competency management, and digital compliance.

This whitepaper outlines practical approaches to reducing risk and improving worker protection throughout mining operations.

1.0 MINING OPERATIONS & FALL HAZARDS

Mining environments present numerous situations where workers are exposed to fall hazards.

Surface Mining

Common activities include:

- Conveyor inspections
- Crusher maintenance
- Highwall monitoring
- Mobile plant maintenance
- Stockpile management

Typical hazards include:

- Open edges
- Elevated platforms
- Slippery surfaces
- Falling objects

Underground Mining

Typical exposure areas include:

- Shafts
- Ladderways
- Raises
- Ore passes
- Pump stations

MINING FALL PROTECTION & RESCUE WHITEPAPER

Additional risks include restricted rescue access and limited emergency response capability.

Processing Plants

Processing facilities contain some of the highest concentrations of work-at-height activities, including:

- Screens
- Crushers
- Tanks
- Silos
- Structural steelwork
- Elevated walkways

The combination of height, confined spaces, and maintenance activities creates a complex risk environment requiring specialised controls

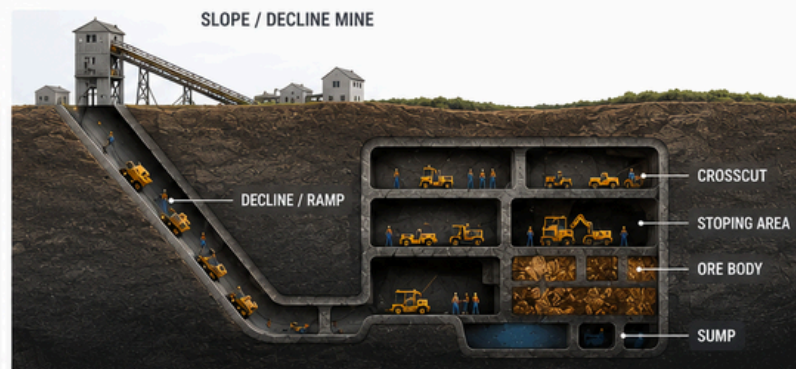
TYPES OF MINES

OVERVIEW OF SURFACE AND UNDERGROUND MINING OPERATIONS

SURFACE (OPEN PIT) MINES



UNDERGROUND MINES



TYPICAL MINING OPERATIONS



DRILLING

Drilling blast holes to break the rock



BLASTING

Breaking rock using explosives



LOADING

Loading blasted material



HAULING

Transporting material to processing



CRUSHING

Reducing size of the material



CONVEYING

Moving material using conveyors



STOCKPILING

Storing material for processing or transport

1.1 SHUTDOWN & TURNAROUND MAINTENANCE

Mining shutdowns and turnarounds present some of the highest concentrations of work at height and confined space activities across an operation.

During planned maintenance events, large numbers of employees and contractors may be working simultaneously across processing plants, conveyors, crushers, tanks, silos and structural steelwork. The increased workforce, compressed schedules and multiple work fronts can significantly elevate exposure to fall hazards and complicate emergency response activities.

Common challenges include:

- Large contractor workforces
- Simultaneous operations across multiple areas
- Temporary access and work platforms
- Temporary anchor systems
- Confined space entry activities
- Changing work environments
- Restricted access for rescue teams

Effective risk management during shutdowns requires a coordinated approach that integrates fall protection, rescue planning and permit-to-work systems.

Key control measures include:

- Site-specific risk assessments
- Verification of anchor points and lifeline systems
- Inspection of fall protection equipment before use
- Clear permit-to-work coordination
- Defined rescue procedures for each work area
- Competency verification for personnel performing work at height
- Emergency response planning and communication protocols

Particular attention should be given to rescue preparedness. In many shutdown environments, work is conducted simultaneously across multiple elevated locations, making access to a suspended worker more complex. Rescue equipment, trained personnel and documented recovery procedures should be available before work commences.

By integrating fall protection and rescue requirements into shutdown planning processes, mining organisations can reduce exposure to high-consequence hazards while improving workforce safety and operational efficiency.

2.0 UNDERSTANDING FALL PROTECTION

Effective fall protection starts with risk assessment rather than equipment selection.

The hierarchy of controls should always be applied:

1. Eliminate the hazard.
2. Introduce engineering controls.
3. Implement administrative controls.
4. Apply fall protection equipment.
5. Establish rescue capability.

Fall protection equipment should be viewed as one component of a complete risk management system.

A successful program includes:

- Risk assessment
- Safe work procedures
- Competency management
- Equipment inspection
- Rescue planning
- Continuous improvement



3.0 FALL PROTECTION SYSTEMS FOR MINING

A complete fall arrest system consists of five key elements:

Anchorage

A secure structural connection point.

Full Body Harness

The primary body support component.

Connecting Device

Typically a lanyard or self-retracting lifeline.

Rescue Capability

Means of recovering a suspended worker.

Competent User

A trained and authorised worker.

Recommended Mining Applications

Application	Recommended
Conveyor Systems	• Full body harness • SRL • Horizontal lifeline
Crusher Access	• Harness • Sharp edge SRL • Rescue kit
Fixed Ladder Systems	• Vertical lifeline • Guided fall arrester
Tank Access	• Rescue harness • Retrieval system • Davit or tripod

Connections should always be made to the dorsal attachment of the full body harness conforming to EN 361:2002 or AS/NZS 1891.1:2020 using a connector complying with EN 362:2004, EN 362:2004 with a minimum gate strength of 6 kN, or applicable ANSI requirements.

4.0 RESCUE READINESS – THE MISSING LINK

Many fall protection programs focus on preventing falls but fail to adequately address rescue.

A worker may survive a fall but remain suspended and unable to self-rescue.

Potential consequences include:

- Suspension trauma
- Restricted circulation
- Loss of consciousness
- Secondary injury

Every work-at-height activity should have a documented rescue plan.

A rescue plan should identify:

- Rescue personnel
- Rescue equipment
- Communication methods
- Recovery procedures
- Emergency contacts

Recommended Rescue Equipment

- Rescue SRLs
- Retrieval systems
- Rescue harnesses
- Evacuation devices
- Rescue kits

The effectiveness of any rescue plan depends on regular training and practice.



5.0 CONFINED SPACE ENTRY & RESCUE

Confined spaces are common throughout mining operations.

Examples include:

- Tanks
- Silos
- Hoppers
- Sumps
- Process vessels

Key hazards include:

- Oxygen deficiency
- Toxic atmospheres
- Engulfment
- Restricted access
- Difficult rescue conditions

Prior to entry:

- Conduct gas testing.
- Complete permit requirements.
- Establish rescue capability.
- Verify worker competency.

Every confined space entry should include a means of immediate retrieval.

Recommended systems include:

- Tripods
- Davit arms
- Retrieval winches
- Rescue SRLs
- Rescue harnesses



6.0 DIGITAL COMPLIANCE & SMART SAFETY

Mining organisations increasingly require visibility over worker competency and equipment status.

Digital compliance systems provide:

Asset Traceability

Tracking of:

- Harnesses
- SRLs
- Rescue equipment
- Anchors

Digital Inspections

Management of:

- Inspection records
- Defect reporting
- Equipment history

Worker Passport

Verification of:

- Working at Heights
- Confined Space Entry
- Rescue Competency
- Site Inductions

Digital systems improve accountability and help ensure equipment remains compliant and ready for use.

7.0 MINING APPLICATIONS ACROSS AUSTRALIA & SOUTHEAST ASIA

Application	Common Hazards	Recommended Controls
Iron Ore Operations	• Conveyor systems • Crushers • Stockpile facilities	• Horizontal lifelines • SRLs • Rescue systems
Coal Mining	• Shaft access • Fixed ladders • Underground infrastructure	• Vertical fall arrest systems • Rescue equipment • Competency management
Gold & Copper Mining	• Processing plants • Elevated maintenance • Confined spaces	• Rescue systems • Retrieval equipment • Engineered anchor systems
Nickel Processing Operations	• Shutdown maintenance • Structural access • Confined spaces	• SRLs • Horizontal lifelines • Rescue systems

8.0 CASE STUDY – CONVEYOR MAINTENANCE IMPROVEMENT PROGRAM

Challenge

A mining operation identified elevated fall risks during conveyor inspections and maintenance activities.

Workers regularly accessed elevated walkways and transfer towers where fall exposure existed.

Solution

The site implemented:

- Full body harnesses
- Self-retracting lifelines
- Horizontal lifeline systems
- Rescue procedures
- Digital inspection management

Outcome

- Improved compliance
- Better worker protection
- Increased rescue readiness
- Reduced exposure to fall hazards

Key Learning

The most effective fall protection programs combine equipment, procedures, training, and rescue capability.



9.0 CONCLUSION

Mining environments present unique challenges that require more than basic PPE compliance.

Organisations seeking to reduce risk should focus on:

- Hazard identification
- Engineered controls
- Fall arrest systems
- Rescue preparedness
- Competency management
- Digital compliance

By integrating these elements into a single safety strategy, mining organisations can significantly reduce exposure to high-consequence hazards while improving operational performance.

KStrong supports mining operations throughout Australia and Southeast Asia with integrated fall protection, rescue, confined space, engineered systems, and digital compliance solutions designed specifically for the demands of modern mining operations.

ABOUT KSTRONG

KStrong is a global provider of fall protection, rescue, confined space, engineered systems, dropped object prevention, and digital safety solutions.

Serving mining, construction, utilities, telecommunications, infrastructure, energy, and industrial sectors, KStrong delivers integrated solutions designed to protect workers operating in high risk environments.

Australia | New Zealand | Singapore | Indonesia | Malaysia | Philippines | Thailand |
Vietnam | Papua New Guinea



KS GROUP

KStrong Asia Pte Ltd
#12-05, OG Albert Complex, 60 Albert
Street, Singapore 189969
Email: customercare@kstrongasia.com

www.kstrong.com/asia

USA

SOUTH AMERICA

AUSTRALIA

NEW ZEALAND

ASIA

A large, solid red triangular graphic element is positioned in the bottom right corner of the page, pointing towards the top right. It is separated from the dark grey background by a white diagonal line.